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THESIS

COST BENEFIT ANALYSIS OF DISTANCE LEARNING ALTERNATIVES FOR DOD UNIFORMED PERSONNEL AND CIVILIAN EMPLOYEES

by

Marge M. Sell

June 1998

Thesis Co-Advisors: Steven R. Lamar
Gordon Louvau

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This thesis supports the evaluation of standard classroom course conversion to distance learning alternatives for disseminating advanced education at the Naval Postgraduate School (NPS). Distance learning is widely used throughout business, military, and academic organizations. Distance learning is convenient and gaining significant interest and importance to military personnel in assignments which hinder standard classroom attendance. This study focused on developing methodologies that could properly support a cost comparison for conversion of standard classroom instruction to distance learning. This study involved personal interviews with both military and civilian professors and other academic experts in distance learning design and implementation as well as a review of the literature. This thesis recommends NPS conduct further research to design a data base to collect reliable and relevant cost data to support future cost studies. NPS should also compare equivalent existing distance learning courses for content currently offered at various institutions other than NPS for consideration as possible substitutes for NPS classroom instruction.

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COST BENEFIT ANALYSIS OF DISTANCE LEARNING ALTERNATIVES FOR DOD UNIFORMED PERSONNEL AND CIVILIAN EMPLOYEES

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ABSTRACT

This thesis supports the evaluation of standard classroom course conversion to distance learning alternatives for disseminating advanced education at the Naval Postgraduate School (NPS). Distance learning is widely used throughout business, military, and academic organizations. Distance learning is convenient and gaining significant interest and importance to military personnel in assignments which hinder standard classroom attendance. This study focused on developing methodologies that could properly support a cost comparison for conversion of standard classroom instruction to distance learning. This study involved personal interviews with both military and civilian professors and other academic experts in distance learning design and implementation as well as a review of the literature. This thesis recommends NPS conduct further research to design a data base to collect reliable and relevant cost data to support future cost studies. NPS should also compare equivalent existing distance learning courses for content currently offered at various institutions other than NPS for consideration as possible substitutes for NPS classroom instruction.

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I. INTRODUCTION

The transition from standard classroom instruction to distance learning technologies could enhance military readiness capabilities. These technologies could result in cost containment or savings in a resource constrained environment. Implementation of distance learning technologies throughout the military could be an overall benefit toward retention and increased personnel morale. Providing continuous education opportunities could assist personnel in timely up to date knowledge and skills application through out their career advancement when the opportunity for attending full time school is not available.

A driving factor for transition within the DoD is that advanced technology is targeted as the path to meet future military readiness capabilities. This requires considerable adaptation in instructional design, physical settings, administrative and technological support, production facilities and student/teacher preparations. (Reed, 1997)

Selecting and implementing the new technologies available for the virtual university of the future, in concept, is both intriguing and complex. This concept could generate a call for a system reengineering approach to the way higher education is developed and distributed. Imbedded in this process is the issue of decreasing resources and an increased need for highly technically proficient military personnel, the consequence of which may cause a serious dilemma for those responsible for implementing efficient or effective educational programs.

This thesis will develop methodologies to design a comparative cost analysis process of education delivery systems. It will parallel the advantages and disadvantages of these methods in different learning environments and take into account individual learning styles, technology, time limitations, and constraints associated with the approach of the delivery.

An additional factor of consequential value is the existing student accession P-coding process commonly referred to as the Quota system. This P-coding process establishes student accession limits, based of congressional resource constraints and total end strength measures. This sets limits on the number of students that can flow through the fully funded education system at the Naval Postgraduate School.

The intent of this thesis is to research the possibility of providing more educational opportunities to more personnel with greater efficiency and effectiveness. This research may result in defining education delivery options that could achieve overall financial savings, enhance military readiness levels, increase required technical proficiencies and defined learning outcomes; and maximize promotion opportunity. This goal will meet the future needs of a military readiness level subject to financial constraints more stringent than previously imposed.

A. ASSUMPTIONS

The underlying assumptions of this thesis are:

- Graduate level education is essential for military readiness to achieve the technical skills, current knowledge, and retention values necessary.
- The Quota system is a limiting factor to both the accession process and as a measure of success.

- Education levels should increase if more learning distribution options are made available to potential students.

- Savings will be realized following transformation of some of the standard core curriculum courses to distance learning methods as a result of reaching more DoD personnel and decreasing the school tour residency period.

- Investing in DoD personnel will increase retention in the organization.

- The residency requirement for a student can be shortened, thus increasing productivity levels in the workforce, while simultaneously increasing the number of accessions.

- Only direct costs that are effected by volume will be accounted for in the formula, because those are the only ones that will change as a result from decisions made. This is relevant in that direct variable and common fixed costs will remain regardless of distance learning methods implemented.

B. BACKGROUND

The NPS is faced with fulfilling the educational needs of the future military leaders of the United States in a continuously resource constrained environment. This is not a new issue and the mission to today's leaders is still as follows: "Leadership in today's rapidly changing Navy requires long range planning and effective use of all assets. As the downsizing and restructuring of our Navy evolves, all must take great care to safeguard the most treasured resource: people. The men and women who make up this force depend upon sound leadership to chart the way. All must commit to professionalism and be the example, guide those served and model the core values this nation was founded upon, showing dignity and respect to all. Continuous improvement must be the battle-cry. Command excellence and mission readiness can only be achieved through a constant dedication and commitment toward this cause. Training is essential to prepare effective leaders for the responsibilities they face." (Kihune,1993)

C. PURPOSE

This thesis will attempt to illustrate a methodology for matching efficient educational delivery models to effective learning styles, and compare the relevant costs associated with each evaluation method. The cost variables when available could reflect a comparative return on investment or payback period cost benefit. Once the appropriate data becomes available a comparative measure could be defined as a unit cost factor that could be directly related to each method. This may become one factor for choosing among courses that are best suited for converting to alternative distance learning models for use at the NPS.

D. RESEARCH QUESTIONS

1. What variables are required to establish methodologies for cost benefit and cost analysis research of distance learning alternative application at NPS?
2. Is there a cost comparison factor that is relevant and reliable for selecting a distance learning alternative?

E. SCOPE

This research will (1) address issues restricting individual personnel in attaining advanced degree education due to the existing quota systems and tour constrictions; (2) determine the advantages and disadvantages of implementing alternative learning methods into the Systems Management Curriculum: (3) identify courses that could be developed to parallel the learning environment and individual learning styles related to the technology applications.

F. METHODOLOGY

The research protocol includes the following steps: (1) defining the curriculum core similarities to establish a structure of comparability; (2) defining the parameters for selecting the best distance learning alternatives for selected core courses; and (3) determining how to compute a “direct unit cost to select criteria for course transition to distance learning.

The following formulas could be used as the basis for a cost comparison:

ROI

Annual Savings/Average Investment = (%)

Payback

Total Investment/Annual Savings = (Time)

Unit Cost

Total Direct Cost/Student Course Hours = ($)

This may establish the working model for evaluating a cost basis for other courses considered for conversion to alternative delivery methods. This data could also support decisions related to changes in the curriculum to meet requirements related to NPS budget constraints.

G. ORGANIZATION

This study consists of six chapters. Following the introduction and background found in Chapters I and II, Chapter III describes the process of developing alternative learning models, Chapter IV provides the detailed methodologies of how all costs could be calculated to compute a comparative analysis of one learning alternative to another provided appropriate data were available. This chapter further explains any underlying assumptions, learning alternative advantages and disadvantages and limitations, associated with matching alternatives to learning environments. Chapter V is an example of cost data variables. Finally, Chapter VI provides conclusions and recommendations.

II. MISSION BACKGROUND

A. ENVIRONMENT

The organizational design of the Naval Postgraduate School (NPS) process is dynamic, intricate and uniquely complex. This observation is the context in which this thesis is based. To understand the complexity a brief explanation describing three components is provided. These components are the processes of financing, authority, and student accession. This will set the tone and transition into the issues to follow.

The Naval Warrior must be adequately prepared to provide support, fight, win, and maintain daily operations in a multitude of situations. The task is to bring together the mission and the resources needed to achieve the output desired.

Military Readiness is a measurable output developed through a designed strategy. Strategy is defined as the stream of decisions about how organizational resources will be configured to meet the demands, constraints, and opportunities within the context of the organization's history. One perspective on this issue as stated is, "Measuring readiness is like nailing Jell-O to a wall." The dilemma is that time and resources are out of balance so that the highest possible level of readiness for every unit can not be afforded at all times. It would seem that the answer is to find a way to calculate the cost of change in readiness. The answer is not always throwing more money at the issue but analyzing where, how, and when the money is spent. What analytical method would be most effective in assuring the validity of the readiness resource allocation equation? One approach is that at low-level units, readiness should be measured in units of time. For training, readiness measurement is inherently a scheduling problem. In higher level units, readiness can and should be measured from a resource perspective; this calculation is inherently an assignment problem. Readiness can be measured rigorously, but in doing so, presents many analytical challenges even to professional researchers. (Raffensperge and Linus, 1997)

Military readiness is established and maintained through effective leadership. This can only happen through programs derived from both academic and active duty force components. In support of attaining military readiness the NPS's mission statement includes the phrase "to increase the combat effectiveness of the armed forces of the United States by providing quality education." Current strategy involves the application of technology to acquire the effectiveness necessary to meet the needs of combat readiness for the future. This was the message given by the new superintendent at a Student Group Lecture.

1. Organizational Design

To help assist in understanding the nature of the design a crude Organizational Chart is provided.

President of the United States

Chief of Naval Operations (CNO) OP00

Vice Chief of Naval Operations OP09

N1:DCNO Manpower, Personnel and Training OP-01

N7:Naval Education & Training Command

N82: Fiscal Management Division

NPS

N82 functions are listed for clarity and understanding:

- Develops, reviews & executes Navy budget
- Translates program requirements into appropriation requirements
- Reports execution results to USD
- Requests allocation from FMO
- Justifies budget request to USD

2. Task

Meeting the mission at all levels requires looking into the organizations structural design and understanding each level of input toward the end product, the student.

The Major Functions of the Military Departments, Under their respective Secretaries, are to:

- Prepare forces and establish reserves of manpower, equipment, and supplies for the effective prosecution of war and military operations short of war and plan for the expansion of peacetime components to meet the needs of war;
- Maintain in readiness mobile reserve forces, properly organized, trained, and equipped for deployment in emergencies;
- Recruit, organize, train, and equip interoperable forces for assignment to unified and specified combatant commands;
- Prepare and submit budgets for their respective departments;
- Develop, house, supply, equip, and maintain bases and other installations and furnish administrative and logistic support for all forces and bases; and
- Assist each other in the accomplishment of their respective functions.(AFSC PUB 1,1993)1-10

3. Strategy

A monumental strategy is to fully embrace the integration of advanced technology throughout the Department of Defense as prescribed in the following guiding principles.

The President of the United States mandates that it is an obligation to provide the best training for federal employees at the lowest possible cost. The following plan was set as the guideline to the National Economic Council, the Chief Information Officers Council, the Office of Personnel Management, and the Office of Science and Technology.

- Make full use of best commercial practices when purchasing instructional software;
- Work with businesses, universities, and other appropriate entities to foster a competitive market for electronic instruction;
- Develop a model technical approach to facilitate electronic instruction building on existing agency efforts, such as the Advanced Distance Learning Initiative Partnership;
- Develop and support a program of research that will accelerate the development and adoption of new instructional technologies. (Clinton, 1998)

Admiral Boorda, as the Chief of Naval Operations, set forth the following standards regarding a level of commitment in support of graduate education:

> I reaffirm the investment in graduate education of selected officers to be a strategic requirement for the Navy. With today's technological, managerial, political, and economic complexities, the need for graduate level expertise has never been greater. The educational development of officers in specific subspecialties greatly increases operational readiness and, as a corollary benefit, develops the intellectual diversity and capacity that enhances the total professional performance of our officer corps. Our investment in graduate education must be pursued as a priority even in the face of competing demands and declining resources. The NPS will remain Navy's primary source of fully-funded graduate education. NPS will remain committed to the development of curricula that meet the highest

> standards of excellence and the unique professional needs of the Navy and the Department of Defense (DoD). Subspecialties that do not require military-unique education will use civilian universities to provide graduate education to their officers. The Superintendent, NPS will administer the Navy's fully funded graduate education curricula at other DOD graduate institutions and at civilian universities. N8 and N09B will ensure NPS has the resources needed to offer excellent curricula. (Boorda,1994)

4. Future Trend and Decision Making Factors in the Big Scheme

Current trends in leadership and knowledge requirements are in strategy transformation at both the individual and organizational levels.

Some of this transition will be through utilizing distance learning programs effectively. This can only be accomplished through critical design and cost analysis. In order for this to be meaningful and relevant a multitude of variable costing and quality factors should be provided in the decision criteria.

Access to knowledge is the wave of future success. Knowledge is power when shared and coupled with the authority to utilize it appropriately for an organization's effectiveness and efficiency. Access to the knowledge is what distance learning is all about. The goal is to provide the tools that support the outcome of a job well done. This principle may change teaching technology throughout the organization.

The effective leader seeks balance in mission requirements and resource availability to maintain a status of comfort and equilibrium within the organization. An educated leader can recognize the need for change to bring about the balance and equilibrium to remain an effective/efficient organization. A look into the future of higher education and how it will effect the competitive edge in our educational facilities is based on cost effective and principled business decisions.

Mr. Conley in 1993 commented: the most striking observation one reaches about technology in education over the past dozen years is not its impact but its lack of impact. Informational technologies have been adapted into the central offices, but "technology has not revolutionized learning in the classroom, nor led to higher productivity in schools. While telecommunications may prove to be a powerful tool for restructuring, its use at this point is primarily to expand, not to change, the existing curriculum by offering courses such as Physics or French to schools not otherwise able to offer them and by employing traditional instruction strategies." Certain technologies have definitely found niches in education, Smith and O'Day (1990) say that the technology of the last two decades has changed far less than it has the worlds of work, entertainment and communication. On the whole, they say, teachers have simply closed their classroom doors and gone right on teaching just as they were taught. (Portway, 1994)

Mr. Thomas relates in his article: In the book, "Competing for the Future," C. K. Prahalad and Gary Hamel suggest that major paradigm shifts in an industry never start with the leaders. Major change comes from the upstarts, the organizations who are willing and can afford to take risks. Thus far, corporate universities have been these risk takers, and have consequently moved to an innovator role in business education. As corporate universities adjust to market trends, capitalizing on their responsiveness, relevance, reach, resources and cost-effectiveness, it is imperative that other educational institutions, especially traditional business schools, particularly those not in Business Week's top 25, become aware of this new competitor and re-think their position. Those who don't may not be around for very long. (Thomas, 1997)

An article in the magazine "Money and Management" supports economic concerns for the future of education in the following passages. Educational market forces make competition a concern for all higher education institutions. Within little more than five years, post secondary proprietary education has been transformed from a sleepy sector of the economy, best known for mom and pop trade schools, to a $3.5-billion-a-year-business that is increasing dominated by companies building regional and even national franchises. The incentives take on the "Instead of digging into tax coffers or mounting fund-raising campaigns, for-profit education companies turn to the stock market." "The whole move to public ownership is an important move in higher education" because it is attracting capital talk, says Robert B. Knutson, chairman and chief executive officer of Education Management Corp., a Pittsburgh company that operates art institutes and culinary programs. As noted in the Wall Street Journal: Computer Learning Centers, based in Fairfax, Va., own and operator 17 computer-training schools, reported in November that its earnings for the most recent quarter were up 85 percent and it's revenues

> were up 52 percent. Legg Magon's Mr. Soffin is recommending that investors buy the stock, on the basis that the company has found the "sweet spot" of the education market: information-technology training. (Strosnider, 1998)

5. Governing Factors that Guide the Process

The following data were gathered from the Officer Subspecialty System Handbook, 1997. The goal of the Subspecialty System and NPS education program is to provide sufficient officers with subspecialties for which current and projected valid billet requirements exist. Officers educated under this program will receive graduate instruction essential for performance of duty in accordance with subspecialty competency requirements. A secondary objective of the program is to continue the education of all officers, and thereby, raise the technical and managerial competency of the officer corps.

a. Background

The Navy funds graduate education to meet subspecialty requirements to the fullest extent possible. Department of Defense monitors utilization of sub-specialists qualified through funded graduate education to ensure maximum return on investment and retention of these highly qualified officers.

Due to the nature of the military and readiness contingencies a dynamic system for planing and executing force structure is essential. Currently this program uses three processes to manage and maintain this balance. The three processes are: P-Coding, Quota Plan, and the Naval Officer Subspecialty System. OPNAVINST 1000.16 series. Approved Subspecialty Codes are listed in the NAVPERS 15839. This process has been in place since 1975.

b. P-Coding

A P-Code is a general suffix criteria that implies the position coded requires extensive knowledge of theories, principles, processes and/or techniques certified through the acquisition of the master's degree for optimum performance of duty; also requires the conception, implementation, appraisal or management of complex Navy and /or DoD programs.

c. Quota Plan

The goal is to reach a steady state for all curricula, thus eliminating large fluctuations in student input and making the most efficient use of P-coded officers. The model is designed to assume that all quotas generated will be filled at the right time and that P-coded officers will be utilized at every opportunity.

While the quota model identifies the ideal graduate education input for each subspecialty area to satisfy one hundred percent of requirements, the published quota plan typically reflects fact-of-life constraints imposed by officer shortages, operating tempos, among other things including fiscal and numerical constraints imposed by Congress, manning levels, availability of qualified volunteers, and so forth. The quota plan shows the actual input planned for the fiscal year in question. This plan is tracked quarterly. Overfill requests for stated quotas can be made by the detailers, the people responsible for matching personnel billet and assignment through PERS-440B. These requests will be evaluated by the Curricular Officer, Academic Associate, and Department/Group Chair to determine if space and faculty budget will accommodate the request.

d. Subspecialty System

The Naval Officer Subspecialty System is a professional development system in which requirements for specific professional qualifications are identified by the Chief of Naval Operations (CNO). The Deputy Chief of Naval Operations for Manpower, Personnel And Training (N1) identifies, develops, and assigns officers to meet these requirements. The Director of Naval Training (N7) provides the necessary education policy and has administrative responsibility for the Navy's fully-funded education programs in support of the subspecialty system. The Assistant Vice Chief of Naval Operations (NO9B) provides the necessary education resources. This system is in accordance with OPNAVININST 1000.16.

e. Utilization

(1) **Requirements.** Utilization of fully funded graduate education is a critical part of the officer subspecialty system and requires careful management for return on investment and retention.

The DoD Policy on Graduate Education for Military Officers is DoD Directive 1322.10 and dictates as follows:

- Considers all officers who possess a graduate degree and grade required for assignment to a validated position as available for assignment to that position.
- Requires that officers who receive fully or partially funded graduate education serve in a validated position (requiring that education) as soon as practicable after completion of the education, but not later than the second assignment following completion of that education.
- Ensures that each officer holding a graduate degree serve in as many positions appropriate to that degree as Military Service requirements and career development permit.

- Requires that the minimum active duty obligation for officers who have received fully funded or partially funded graduate education shall be a period equal to three times the number of months of such education completed during the first year of graduate school and one month for each month there after unless a different period of time is prescribe by Law

(2) **Study Results.** A NPS utilization rates study provided by the Center for Naval Analysis in January 1998 revealed:

> For officers who earned their P-Code in years 1984 through 1989, we looked at the percentage who served in a utilization tour that matched their program of study exactly, as well as the percentage of officers who fulfilled their obligation by serving in a 'closely related' billet, or some other billet that qualified as a payback tour.
>
> Beginning with the restricted line, we found that slightly more than half of officers (54 percent) filled a billet with and exactly matching subspecialty code, while 91 percent filled some type of qualifying payback tour. Slightly less than half of the officers that filled an exactly matching billet (25 percent of all P-coded officers from the restricted line) were assigned to it within a year of earning their P-code. Two thirds of officers that filled and exactly matching billet (36 percent of all P-coded officers from the restricted line) were assigned within 3 years. The remaining third took more than 3 years to go to this assignment.
>
> Utilization statistics are substantially worse for officers from the unrestricted line. Only 30 percent of officers who earned their P-code in years 1984-89 had been assigned to a tour of duty in a matching subspecialty billet by the fall of 1994, although two-thirds had filled some type of utilization tour at that point. Among officers who did fill a billet that exactly matched their subspecialty, only 19 percent did so immediately (6 percent of all P-coded officers), and about half did so within 3 years. The utilization rate in exactly matching billets is important because the Navy spends considerable resources in tailoring curricula to the education skill requirements (ESRs) for specific jobs. Time utilization is crucial in support of the ESRs for emphasize applications to current Navy problems and use of current Navy systems. Delays between education and utilization dampen the effectiveness of these applications because the currency of information is lost and the amount of information that is retained declines. (Caavalluzzo and Cymrot,1998)

III. DISTANCE LEARNING

A series of independent articles reported in the Navy Times indicates support of education and distance learning programs. CAPT L. Wilson, the Navy's top officer-strength planner addresses balance in end strength. He comments that Navy commissions are increasing due to downsizing effects as the top end retires and the numbers at the bottom aren't balancing the losses. This will happen via the NROTC and OCS. One fifth of the commissions are from the fleet. The Navy would rather keep it's expensively trained officers than recruit new ones. "Retention is really the No. 1 priority, because we've invested the time and money," said LCDR Lydia Robertson, a personnel bureau spokesman. "We work with the accessions to build up behind that." (Peniston,1998)

The article titled, "Study says smart money is on education," states "scholarly sailors are more likely to stay, advance." Paul Plawin of the American Vocational Association says, "You retain quality employees by offering career-enhancing education." "Instead of looking to move on, a common problem in industry today, they're looking to move up." (Burlage,1998)

Navy LCDR Franchetti, a career Naval officer is one of the seven million students, according to Pam Dixon, author of Virtual College, achieving success through distance learning programs. LCDR Franchetti comments, "It's no secret that barriers exist for military members interested in obtaining education. Long work hours, frequent travel, and repeated relocation are some examples." Now I no longer have to worry about changing duty stations before I finish my degree, or losing time, credits and money on courses that won't transfer to another school." Distance learning is growing. In 1993 only 100 accredited institutions verses 750 in 1998 were listed in references in North America. (MrBride,1997)

The evaluation of training is paramount to meeting corporate goals. Evaluation of all training is crucial to supporting the notion that training is a key component to company success. (Crum,1995)

A. BACKGROUND

The following data was gathered from the Distance Learning Resource Handbook from the Air Force Distance Learning Office (1997). A brief history of the concept of distance learning indicates the impact this technology has had on educational delivery options. This review suggests that there are many factors to be considered and desired in using this approach to support the educational process. Following this analysis some general facts are given to emphasize the importance of this undertaking. For a point of reference and clarity of terminology a "Glossary of Terms" is found in Appendix A.

Distance learning is more than 200 years old. In fact, the Boston Gazette ran ads for shorthand lessons by mail in 1728. Australia's University of Queensland offered an external degree program in the 1890's. Columbia University offered extension programs in the 1920s while other schools began using radio to disseminate education in the 1930s.

Distance Learning has been a normal part of education and training programs for many years. Using paper-based media, a variety of programs from career development courses to Professional Military Education correspondence courses have met varied education and training needs. The Air Force, for example, in 1950 founded a correspondence school, the Extension Course Institute that supports formal training and educational programs for the Air Force, Air National Guard and Air Force Reserves.

Since then, operations training, professional military education and continuing education courses are using floppy diskettes, videos, CD-ROMs, interactive satellite broadcasts, video teletraining seminars, the World Wide Web and other media to deliver education and training courses worldwide.

> Distance learning is the acquisition of knowledge and skills through extended information and instruction, encompassing all technologies and other forms of learning, wherein a time and/or physical distance between student and instructor exists. (Kimberly, 1996)
>
> Open Learning is a PHILOSOPHY-one of giving learners more access to learning and more choice and control over what and how they learn. Sometimes this means merely that learners are able to choose the time, place and pace of their learning. But it can extend to opening the learning to new kinds of learners (e.g., less qualified or wealthy ones) and/or giving them choice about what and how and with whom they learn. It may or may not involve distance learning. Distant Learning/Education is a TECHNOLOGY—one that enables learners to learn without being in the same place as their teacher, e.g., with the aid of self-teaching materials (like specially prepared workbooks, textbooks, multimedia packages), WWW material, resources available in community or workplace, conferencing and, correspondence with a supportive distant tutor. It may be no more open than conventional courses. (Dr. Derek Rwontree, Professor of Educational Development, The Open University).

1. Facts about Distance Learning

A U.S. Department of Education Study on Distance Education in Higher Education reports the following:

- 58% of all higher education institutions offered or planned to offer distance education courses;
- An estimated 25,730 DE courses with 753,640 students enrolled were offered in the academic year 1994-95;
- An estimated 690 degree programs and 170 certificates were offered exclusively at a distance;
- Three-fourths of the institutions developed their own course curricula; one third purchased courses from vendors;

- Types of technologies used include:

  Two-way interactive video (57%)

  Two-way audio with one-way video (24%)

  One-way pre-recorded video (57%)

  Internet and other computer-based technology (36%)

- The most common technologies to be pursued during the next three years were two-way interactive video and online/computer-based, as identified by three-quarters of the institutions.

The four most important reasons for offering distance education courses:

1. Increase student access by making courses available at convenient location (82%).
2. Increase access to institutions by new audiences (64%).
3. Increase student access by reducing time constraints for course completion (63%).
4. Increase institution enrollments (54%).

2. College Courses and the E-Mail

The annual Campus Computing Project survey shows that nearly 33% of courses offered at the 605 institutions polled use e-mail, up from 25% in 1993 and 8% in 1994. At private universities, the percentage of courses using e-mail is 60 percent and nearly half of public university courses use it. More than 14 percent of all institutions put class materials, such as syllabi, on the Web and more than 24% use other Web resources, such as online encyclopedias. (Chronicle of Higher Education, 17 Oct 97)

3. Other Statistics

- In 1995, more students enrolled in distance education courses than entered all the US colleges and universities as freshmen. (ED, Education at a Distance, March 1997).

- More of the $50 billion spent annually on employee education is going into distance education (Home Education Network, 1997).

- Demand for technology-based training will rise 10% a year to $12 billion in 1998 (Gartner Group,1997).

- By the year 2000 half of all corporate training will be delivered via technology (Quality Dynamics Inc, 1995).

- Web based IT training will grow from $92 million in 1996 to $1.7 billion in 2000, with an emphasis on Intranet-based, asynchronous, self paced instruction (9/8/97 Web Week).

- John Bear says that his Guide to Earning College Degrees Nontraditionally now lists 87 properly accredited American colleges and universities with degrees 100 % by distance learning, and 117 with very short residency requirements (4 weeks or less). And, his update site on the web lists 20 more new degree programs. See http://www.degree.net.

- About 48% of companies with more than 100 employees are using computer-based training. (Training Magazine 1995 Industry Report).

4. Western Association of School Committee (WASC)

As part of the WASC preliminary report, NPS has documented the progress taken to enhance its position concerning distance learning implementation and application strategies in order to decrease the costs of graduate education of naval officers. Specifically, rethinking the issues of officer military education and training in Joint Professional Military Education (JPME)

NPS has entered into the distance learning era as evidenced by many classrooms equipped for VTC, and utilization of these classrooms having increased by 81% over the past year in the Aeronautics and Astronautics, Computer Science, Electrical and Computer Engineering and Systems Management. Defense Resources Management Institute (DRMI) and NPS are interactive via VTC. Most areas of the school are Internet accessible. Many software packages have been purchased to enhance student access to information and have been placed in the Computer Learning Resource Centers. Currently, interactive computer programs are being evaluated for use in the math departments and have achieved a positive student response. The Institute for Defense Education and Evaluation (IDEA) is proposing partnerships with the private and public sector to further develop and distribute education on the Internet. IDEA is also coordinating the development of DL courseware products in support of its Executive Management Education (EME) program for BUMED. The library is working on accessing electronic resource material to complete the online data available for a more complete reference library. Overall NPS is moving to integrate distance learning technologies into its graduate curricula and is collaborating with organizations also seeking to establish distance learning committees and capabilities to meet the military graduated education requirements of the future.

B. LEARNING STYLES

Every one has a different approach to learning. Given this fact it is ideal to choose to teach to a learning style. The learner needs to understand his or her personal style of learning. The information about these styles is paraphrased from the book: Becoming a Master Student Eighth Ed. by David Ellis, 1997.

1. Application Styles

- ***Diverging***: The learner considers a situation from different points of view and determines why it is important to learn a new concept, strategy, idea, technique, or method.
- ***Assimilating**:* The learner absorbs the information provided to achieve a complete understanding. The learner is interested in knowing what strategies, ideas, techniques, or methods are important. The value is in learning lots of facts and then arranging these facts in a logical and concise manner.

- *Converging*: The learner takes the information gathered and tests it to see if it works. The learner questions if what was learned makes sense? Can the information improve the current situation? This style is concerned with how the strategy, idea, technique or method works. It is important to be able to apply the new information to a practical model.

- *Accommodating*: The learner takes what is practiced and finds other uses for it. The learner asks where else does this apply?

2. Models

1. **Concrete Experience (*feeling*):** Learning that is a result of the learner feeling like the things learned are important and relevant to today.

2. **Reflective Observation (*watching*):** Learning that is a result of watching others planing things out and taking time to make sure that what is learned is accurate.

3. **Abstract Conceptualization (*thinking*):** Learning that results in familiarization with ideas, facts and figures and thinking about many concepts and lots of information on a new topic.

4. **Active Experimentation (*doing*):** Learning that applies new techniques to ideas, trial and error, and "hands on" practice.

For clarity an example of a learning cycle and learning style is presented: Learning to bungee jump. Perhaps you've experienced bungee jumping yourself or watched someone else do it. Many people prefer to watch this activity rather than participate. They witness a bungee jump and come to a conclusion: "This is one thing that I don't need to learn!" If this is true for you, then your learning ends with Stage 1 *Activist* (Having an experience). You choose not to gather information as in Stage 2 *Reflector* (Reviewing the experience). For example, you don't climb up onto a platform, look over the edge, or ask how to put on ankle straps. Other people might proceed through Stage 2. Some of these people decide they have learned enough and choose not to take the plunge. However, others might decide to make the jump, moving on to action and practice stage 3, *Theorist* (Concluding from the experience). When these people jump, they will automatically integrate the experience with what they know about bungee jumping. And if they decide to jump again, they might even add some new movement or flair to their jump. In short, they will move through Stage 4 *Pragmatist* (Planning the next step)of the learning cycle. These people can truly say of themselves, "I'm a bungee jumper."

C. ELEMENTS OF DISTANCE LEARNING COURSE DESIGN

Criteria are needed when making a choice of which educational delivery process best suits the need of the student. Asking the right questions will make all the difference in making the correct selection of course design. Particular emphasis should be placed on course design. Congruent with one focus of this thesis, one must consider working from two ends of a continuum or spectrum of environment dynamic. A reminder from Chapter I is that one end of the spectrum is an environment where learners have access to high technology learning environments and adequate time to participate in attaining higher education goals. At the other end of the spectrum some technology is available but time limitations interfere with obtaining higher education with any consistency. Please note that these variables are at the extremes and only used to stress the point that we have to look at both to apply learning methods appropriate to both needs. Keep in mind the idea is to extend educational alternatives consistent with the educational needs of career military officers and others that must stay knowledgeable, highly skilled and competitive for promotion.

D. DEVELOPING OBJECTIVES, METHODS, AND EFFECTIVENES

Measures of evaluations must focus on the learning objectives, methods and effectiveness criteria desired to meet the expected results. See Appendix B for ESR descriptions. The development of the methods:

1. Objectives

Knowledge acquisition	Changing attitudes
Problem-solving skills	Interpersonal skills
Participant acceptance	Knowledge retention

Table 2.1. Objectives

2. Methods

Correspondence Courses	Case Studies
Conference discussion method	Lecture with questions
Business games	Movies/film
Programmed instruction Role playing/skill practices	Sensitivity training/T-groups
Television lecture	Computer based

Table 2.2. Methods

3. Effectiveness

Training objective	Most effective method	Least effective method
Knowledge acquisition	Conference method	Television lecture
Changing attitudes	Sensitivity training	Television lecture
Problem-solving skills	Case study	Movie films
Interpersonal skill	Role playing	Television lecture
Participant acceptance	Case study	Programmed instruction.
Knowledge retention	Programmed instruction	Sensitivity Training

Table 2.3 Effectiveness

4. Measures of Evaluation

Ninety-five percent of the time required to set up training should be design and only five percent delivery and packaging. (Doerr,1994)

Measuring the value of training is possible. How to use statistics and bottom-line budgets effectively can eliminate a plethora of obfuscation commonly used to avoid evaluating training. (Fitz-Enz, Jac,1994)

To following is a step-by-step list of measurable criteria to consider in establishing an effective training program.

- Are the program learning objectives consistent with internal objectives?
- Is the recommended length of the program consistent with internal plans?
- Are evaluation procedures designed into the program?
- Does the content match the requirements from the needs analysis?
- Is the method of presentation compatible with existing practices?
- Does the program design require participants to be actively involved in the learning process?
- Are the program materials suitable for the target audience?
- Are there procedures/methods to ensure the transfer of training to the job?
- Can the program be used without modification?
- Does the program allow for skill practices?
- Are supporting material available for the participation's supervisors?
- Is the program attractively packaged? (Phillips,1983, pp. 59and 220)

E. SYSTEMS MANAGEMENT DEPARTMENT

The Systems Management Department offers courses in 12 different fields of study. Currently, employing traditional classroom delivery, theses courses can be completed in 6 to 8 quarters (12 weeks/quarter). Many of the same courses (core courses) are required in each area of study.

The evaluation and comparison of the average student classroom size, average pay-grade of student, and length of time away from work assignments of students attending these courses are some of the cost variables relevant to establishing both savings and cost per course unit delivered. Cost per course unit could be used as a key variable in establishing resource efficiency criteria for course justification for transition to distance learning platforms. In order to adequately portray a savings many factors have to be considered. The following information is representative of a few of the variables. Note that changes with each class would have to be traced as a measure of impact on justified savings.

1. Student Rank Matrix

For the purpose of showing the range of pay grades and military services distributed within Systems Management Department, Table 2.4 is provided for reference.

Service	**Grade 01**	**Grade 02**	**Grade 03**	**Grade 04**	**Grade 05**	**Grade 06**	**Total**
Army			25	2			27
Navy		2	100	71	7		180
USAF							0
USMC			42	26			68
USCG			7				7
International		17	10	9	10	2	48
Civilian			5				5
Total	0	19	189	108	17	2	335

Table 2.4. Student Rank Matrix

2. Pay Scale

To assist in developing the potential savings of using distance learning versus traditional classroom a base pay scale is provided in Table 2.5. The pay is shown in rounded dollars of pay per month.

Years of Service

RANK	4	6	8	10	12	14	16	18	20	W	W/O	BAS
06	4379	4379	4379	4379	4379	4527	5243	5511	5631	1388	1149	155
05	3755	3755	3755	3868	4070	4350	4676	4944	5094	1388	1148	155
04	3275	3336	3483	3721	3930	4109	4290	4407	4407	1236	1075	155
03	3099	3247	3363	3546	3721	3812	3812	3812	3812	1018	857	155
02	2771	2828	2828	2828	2828	2828	2828	2828	2828	927	725	155
03E	3099	3247	3363	3546	3721	3868	3868	3868	3868	1194	1011	155
02E	2771	2828	2918	3070	3188	3275	3275	3275	3275	1041	830	155

Table 2.5. Pay Scale

3. Section Curriculum Matrix

The following table provides data about Quotas, P-Codes, and the number of students currently enrolled in each of the 12 sections within the System Management Department as of May 1998.

SECTION	CURRICULUM	P-CODE	QUARTERS	SPONSOR	QUOTA	Number of Students
MV 813	Transportation Logistics Mgt.	1304P	7	NAVSUP	3	3
MT 814	Transportation Mgt.	XX35P	7	MSC	16	8
MR 815	Acquisition & Contract Mgt.	1306P	6	ASN/RDA	17	38
MO 816	Acquisition Management	None	7/6	ASA/RDA		24
ME 817	Defense Systems Analysis	None	6	VARIC		6

Table 2.6. Curricula Structure

SECTION	CURRICULUM	P-CODE	QUARTERS	SPONSOR	QUOTA	Number of Students
MK 818	Defense Systems Management	None	6	VARIC		9
MI 819	Systems Inventory Mgt.	1303P	6	NAVSUP	5	5
ML 820	Internal Defense	None	6	DSAA		16
MM 827	Logistics Support	XX32P	6	NAVAIR	12	23
MF 837	Financial Management	XX31P	6	N-82	19	48
MP 847	Manpower	XX33P	7	PERS2-	22	37
MD 856	Leadership and Development	XX38P	4	CNET		11
MS 877	Shore Installation	XX34P	6	N-4		7
PM 370	Information Technology Mgt.	XX89P	8	CNCTC	21	14
TOTALS					115	240

Table 2.6 (Continued)

For clarity of the 12 areas of study and the similarities of courses required for a graduate degree Table 2.7 is provided. The table depicts some of the more commonly taken courses. This table serves as a means of identifying which courses are taken by the majority of the students in all sections within the Systems Management Department. See Appendix B Educational Source Requirements (ESR) for a description of the courses by title and content.

4. Course Spreadsheet Matrix

SECTION	370	813	814	815	816	817	818	819	820	827	837	847
COURSE #	0	3										
MN0031		X	X	X	X	X	X	X	X	X	X	X
MN2150		X	X	X	X	X	X	X	X	X	X	X
MN2300		X	X	X	X	X	X	X	X	X	X	X
MN2302				X								

Table 2.7. Courses Matrix

SECTION	370	813	814	815	816	817	818	819	820	827	837	847
COURSE #												
MN2303					X							
MN3105	X	X	X	X	X	X	X	X	X	X		
MN3111									X			
MN3140			X	X	X	X	X	X	X	X	X	X
MN3154	X	X	X		X	X		X		X	X	X
MN3161		X	X	X	X	X	X	X	X	X	X	X
MN3172		X	X	X	X	X	X	X	X	X	X	X
MN3301			X	X		X		E			X	
MN3303				X								
MN3304				X								
MN3305				X								
MN3306				X								
MN3312				X								
MN3333		X	X	X	X	X	X	X	X	X	X	X
MN3371		X	X		X			X			X	
MN3372		X	X					X		X		
MN3373		X	X									
MN3375			X									
MN3377		X									E	
MN4105		X	X	X	X	X	X	X	X	X	X	X
MN4145		X	X	X	X	X	X	X	X	X		
MN4151											X	
MN4153											X	
MN4161						X					X	
MN4162											X	
MN4163								X			X	
MN4163						X						
MN4307					X							
MN4310					X							
MN4373		X	X									
MN4376		X	X									
IS0123		X	X	X	X	X	X	X	X	X	X	X
IS3183		X	X	X	X	X	X	X	X	X	X	X
OS3006		X	X	X	X	X	X	X	X	X	X	X
OS3101		X	X	X		X	X			X	X	X
OS3105	X			X				X	X			
OA4702					E	X					E	
NS3252	X	X	X	X	X	X	X	X	X	X	X	X

Table 2.7 (Continued)

F. COURSE SELECTION CRITERIA

Table 2.8 lists the courses most commonly taken within the Systems Management Department. These courses could be considered for distance learning alternatives based on the following assumptions:

- To allow students to complete the core courses prior to attending NPS. This is an issue for some students that are assigned to billets within commands that can not afford to let a staff member attend a full time school;
- To shorten the number of quarters required to complete a Masters degree;
- The course is essential to military readiness enhancement; and
- To reduce costs and time associated with course completion through existing education systems.

Additionally, there is additional criteria that must be considered for course selection and conversion. The distance learning alternatives should meet the same high standards and quality of classroom instruction, standard ESR objectives can be paralleled, all individual learning styles can be applied, time limitations addressed, and command technology and resource constraints considered.

Another critical factor to be considered in this transition process toward distance learning instruction methods is the command performance indicator of excellence. Currently noted in the GAO/GGD/AIMD-10.1.1.8 Congressional Review of Performance Plans as:

- Defining Expected Performance.
- Connecting Mission, Goals, and Activities.
- Recognizing Crosscutting Efforts.
- Connecting Strategies to Results.

- Connecting Resources to Strategies.
- Verifying and Validating Performance.
- Recognizing Data Limitations.

Conversion Courses Matrix

This matrix shows the courses that are taken by all Systems Management students and could be evaluated for conversion.

Section	370	813	814	815	816	817	818	819	820	827	837	847	DL
MN2031		X	X	X	X	X	X	X	X	X	X	X	*
MN2150		X	X	X	X	X	X	X	X	X	X	X	*
MA2300		X	X	X	X	X	X	X	X	X	X	X	*
MN3140			X	X	X	X	X	X	X	X	X	X	*
MN3161		X	X	X	X	X	X	X	X	X	X	X	*
MN3172		X	X	X	X	X	X	X	X	X	X	X	*
MN3333		X	X	X	X	X	X	X	X	X	X	X	*
OS3006		X	X	X	X	X	X	X	X	X	X	X	*
NS3252	X	X	X	X	X	X	X	X	X	X	X	X	*

Table 2.8. Courses Selected for Distance learning

The average number of students for the courses defined for evaluation is depicted in (Table 2.9) to follow. This data could be used as part of the cost analysis computation in a weighted average structure.

Total Students per Quarter/Sessions Average/Number of Quarters

This table depicts the average size of class enrollment.

Section	96/1	96/2	96/3	96/4	97/1	97/2	97/3	97/4	98/1	98/2	98/3	Total	Average
MN2031	0	31	0	23		18		23		34		129/5	25
MN2150	0	23		28		29		29		26		135/5	27
MA2300	0	15	0	35		22		36		31		139/5	27
MN3161	26		22		31		31		35		29	174/5	35
MN3172	22	20	16	21	24	27	27	22	20	30	29	258/11	23
MN3333	0	24		24	0	23	0	25	0	20	0	116/5	23
MN3105	15	18	19	22	17	17	22	24	19	18	21	212/11	19
NS3252	19	22	19	24	20	19	13	20	25	20	14	215/11	19

Table 2.9. Average Class Size

Total Students/Number of Quarter Average

Sec	96/1	96/2	96/3	96/4	97/1	97/2	97/3	97/4	98/1	98/2	98/3	Total /11	Avg/ Qtr
MN2031		31		92/4		37/2		70/3	38/2	34	21	323	29
MN2150		46/2		114/4		59/2		86/3		53/2		358	33
MA2300		13		105/3		44/2		73/2		31		266	24
MN3140	106/4		41/2		117/4		59/2		93/3		58/2	432	43
MN3161	104/4		45/2		99/4		62/2		106/3		58/2	474	43
MN3172	44/2	40/2	16	62/3	48/2	55/2	27	45/2	41/2	61/2	29	468	43
MN3333		72/3		97/4		91/4		99/4		60/3		419	38
MN3105	15	76/4	39/2	65/3	36/2	71/4	22	72/3		55/3		451	41
NS3252	151/8	157/7	114/6	170/7	91/6	134/7	78/6	162/8	74/4	159/8	69/5	1359	124

Table 2.10. Average Number of Students per Quarter

G. ANTICIPATED BENEFITS AND SUMMARY

According to the research report to the Health Care Committee Executive Board conducted by the Distance Learning Subcommittee the following benefits apply to distance learning alternatives: (July,1997).

- Reduces time away from the workplace;
- Increases access to utilization of satellite and other electronic delivery;
- Provides capability to train deployed and afloat units while underway;
- Allows for improved Total Force training integration;
- Allows for standardized training and focus on learning outcomes;
- Maximizes utilization and sharing of quality instructors, thus potentially reducing instructor personnel requirements;
- Provides a student-driven, learner-centric approach to educational delivery;

- Increases the number of students entering into the graduate education program through increasing the number of annual graduates;

- Expands the scope of the market by providing accredited courses to off-site locations so that individuals can start on an advanced degree in route to an accredited institution;

- Provides continuous education accredited courses for people who don't have time to leave the work place but need to stay current in their field of expertise, thereby accommodating some to the PME requirements for joint military education. Maximizes utilization an sharing of quality instructors, thus potentially reducing instructor personnel requirements;

- A method to decrease the time individuals are out of the productive work force.

IV. METHODOLOGY

This chapter provides a detailed set of methodologies of how cost could be calculated to obtain a comparison of the various learning alternatives provided the availability of data was relevant and reliable to fit the methodology.

Two methods of evaluation are cost efficiency and learning effectiveness. Cost efficiency can be evaluated via several formulas, i.e.: Unit cost, Payback Period, Return on Investment and Unit Contribution. Each of these methods relies on the ability to gather reliable and relevant data. Learning effectiveness is based on the resulting outcomes and outputs established from the standardized organization objectives. Overall effectiveness is achieved when learning style, method and environment match in a cost efficient manner.

Each of the costing methods and alternative learning methods have advantages and disadvantages due to technology, environmental limitations, time constraints, a students knowledge and skill level, as well as individual learning style.

A. COURSE CONVERSION CRITERIA

Course content and the analysis complexity of deriving and relaying the answer set the parameters for which method is best suited for DL application. Knowledge derived and relayed through material that is read followed by fill in the blank, multiple choice, mix and match, short essay type answers matches each of the three assessed course conversion methods, due to simplicity. Classroom instruction is the best method, as the complexity of content comprehension, analysis, and ability to derive, display, and answer increase, and where the need for interaction with a subject matter expert is required. This method, coupled with advanced computer technology support, work well for extremely time consuming, mathematically intensive, multiple step answers, such as linear and multivariate regression analysis.

Computer based learning works well when course objectives are standardized and the answers are specific, or the answer applied is derived through formulas pre set in the computer. The complexity of the program is based on the nature of the learning objective.

Critical impact on output is reflected in the match of student learning style to technology, the environment, time and resources available. What type of student is best suited for DL? One that is self disciplined and motivated. Who chooses DL? One survey says 'Convenience' is the single most cited factor influencing a student's decision to choose to learn at a distance. (International Foundation of Employee Benefits Plans, 1997)

The issue of cost efficiency for NBL course development cost is directly related to the capabilities for providing text, sound bytes, and streaming video. The richer the presentation, the more costly. For example a course with only plain text would have minimal developmental costs, but the experience would be similar to reading a book. Adding sound bytes could improve the presentation and at the same time add costs of up to $100/minute of sound. To have both the visual and sound in a streaming video, cost could increase to $1,500/minute (Lamar, 1997).

B. ADVANTAGES AND DISADVANTAGES

Advantages and disadvantages of any method of teaching is reflected in the results from the student. The more interaction between the student and the material being presented usually results in the best learning outcome. Direct application of the material presented to a specific measurable learning objective is desired as the degree of effectiveness.

1. Computer

Advantages: Results are immediate. Time and place are independent. Learner Centric student driven. Time is at the disposal of the user, provided the equipment is available it can be utilized in all environments.

Disadvantages: The student has limited interaction with the instructor. The student has to have or acquire skills and knowledge to use the software and have access to a computer with modem to access the Internet. Costly to develop, not always accessible due to limited technology.

2. Classroom Instruction

Advantages: There can be a direct relationship with the instructor. Instructor as the subject matter expert can assess the knowledge and skill level of each student and assist as needed directly. The full time student can concentrate on learning.

Disadvantages: The organization may not be able to allow the student the opportunity to attend full time instruction in which case the student must fit the schedule of the school and the command.

3. Correspondence Courses

Advantages: Reading and comprehension skills are all that is required. These courses can be done anywhere at any time.

Disadvantages: The instructor is not directly available to the student. The content of course has to be designed in such away to insure that all relevant material is included.

C. DATA GATHERING

To determine which course type is best suited for conversion to an alternative learning method requires critical evaluation. The course objectives must be attainable while fitting the constraints of resource limitations and student learning styles. The distance learning course content and presentation vary with complexity and are dependent on the depth of skill and knowledge of the developer. The distance learning production and delivery costs are dependent on how elaborate a courseware product is developed.

Many data variables should be considered in order to establish a comparative per unit cost of different course delivery methods. These variables center around three analysis areas: course development, presentation, and cost per student. This data could be used through a variety of costing formulas to derive a cost per unit of learning for each method evaluated. The data to be gathered includes:

1. Expense Categories and Related Variables

1. Instructor Salary
2. Student Salaries
3. Average Class Size
4. Meals, Travel and Incidental Expenses for Staff
5. Meals, Travel and Incidental Expenses and Lodging for Students
6. Office Supplies and Expenses
7. Program Materials and Supplies
8. Printing and Reproduction
9. Outside Services
10. Equipment Rentals
11. Equipment Maintenance
12. Facilities Rental
13. Other Miscellaneous Expenses

2. Standard Cost Variable

- **Student Related Expenses**

  Number of students

  Number per Class

  Number of Graduate Education Sessions Needed

  Length of Graduate Education Session (in hours)

  Student Salary per Hour

  Total Cost of Student Salaries

  Cost of transporting students to a learning center

- **Total Instructor-Related Expenses**

  Number of Graduate Education Sessions

  Length of Graduate Education Session (in hours)

  Number of Instructors per Graduate Education Session

  Initial Instructor Prep Time

  Instructor Preparatory Time per Session

  Instructor Salary Per Hour

  Travel Time To/From Education site

  Total cost of Instruction Salary

- **Total Other related Expenses**

  Number of Graduate Education Sessions Needed

  Total Cost of Classrooms

  Cost of Equipment per Student

  Number of Students

  Total Cost of Equipment

  "Sunk" Cost to Develop Student Materials

  Cost per Student for Materials

3. Marginal Cost Variable

For an additional approach that utilized a different set of variables, a Master's Thesis was dedicated to establishing research about savings. See NPS Master's Thesis, "A Methodology for Determining the Marginal Cost Per Student at the Naval Postgraduate School", by John P. Eckardt, 1997) See Appendix C in this thesis or see page 42, Figure 3.9 in reference named Cost per Curriculum Model Output Page.

4. Contribution Cost Variables

- Revenue or Savings
  Student and Instructor Salaries and Fringe Benefits

- Traceable Variable Costs
  Student Materiel cost
  Instructor Grading Fees
  Instructor Salary and Fringe
  Student Salary and Fringe

- Traceable Fixed Variable Costs
  Course Development Fees
  Editing and Printing

- Common Variable Costs
  Course Development

a. Formulas Used for Evaluation

(1) Return on Investment

Return on Investment: $\dfrac{\text{annual savings}}{\text{average investment}}$

(2) Payback Period

Payback period: $\dfrac{\text{total investment}}{\text{annual savings}}$

(3) Unit Cost

Unit Cost: $\dfrac{\text{total traceable variable, fixed and common costs}}{\text{students x class hours}}$

b. Comparison Cost from Outside Sources

(1) **Civilian Universities.** Using the Peterson's Guide to Distance Learning, 1998 the graph below shows a range of student per unit costs by university for a mix of DL delivery methods. Note the data were randomly selected from universities that had graduate level accounting courses available.

University	**Unit Dollar Cost**	
	From	**To**
Colorado	$ 94	$126
National	$200	
New York	$390	
Old Dominion	$121	$162
Rogers	$105	$148
Alabama	$105	$150
USGIS	$ 63	
UC Berkley	$375	$395
Alaska	$ 71	$158
Average	$169	$199

(2) **Cost Savings.** In evaluating Distance Learning Conversion Costs, it was discovered that by developing a NBI course versus administering a three week Seminar at the Naval Postgraduate School would result in an estimated saving of $23,683.00 per seminar. The NPS Master's Thesis, "Cost Effectiveness Analysis of Converting a Classroom Course to a Network-Based Instruction Module," by Samantha Green December 1997 addressed conversion costs of distance learning.

c. *Cost of Course Conversion Quotes*

Conversion Cost estimates per 3.5 hour module:

- Vendor #1 quote $77,321.
- Vendor #2 quote of $58,300 to $68,300.
- IDEA estimates from literature and course conversion history $20,000 to $50,000 (per converted hour).

V. COST DATA ANALYSIS

A. ASSUMPTIONS

The only costs that are relevant to a cost benefit analysis decision are those costs that vary directly with changes in volume of instruction.

B. COST COMPARISON/SAVINGS

Cost Savings Derived by Not Having Student Attend NPS Classroom Instruction

A	Costs Saved
	Student Salary
	Book Reimbursement
	Savings
	Traceable variable
	Instructor Grading Fee (or salary and Fringe)
	Student Materiel cost
B	Total traceable Variable
A-B=C	Contribution Margin
	Traceable Fixed
	Course Development Fees
	Editing and Printing
D	Total Traceable Fixed
C-D=E	Course Contribution
	Common Costs
	Course Development
F	Total common costs
E-F=G	Net avoided

$$\text{Unit Cost:} \quad \frac{\text{total traceable variable, fixed and common costs}}{\text{students x class hours}}$$

C. APPLICATION TECHNIQUES

Interpret results of three teaching methods against costs.

$$\textbf{ROI} \quad \frac{\textbf{Annual Savings}}{\textbf{Average Investment}}$$

$$\textbf{Payback} \quad \frac{\textbf{Total Investment}}{\text{Annual savings}}$$

Annual Savings
Unit Cost **Total Direct Cost**
Student Course Hours

1. Cost Variable Interpretation

- Savings are what is not lost by sending a student to a full time education.
- Expenses are associated with course development, presentation and students in a full time education status.

D. CONCLUSION OF ANALYSIS

It is conceivable that a comparative analysis could be done if relevant and reliable data was currently accessible. It would be of benefit to collect relevant variables for comparative analysis.

Computer based instruction is best measured by utilizing the payback method due to the high one time front end cost.

For the best results, conversion of any course must meet the need of the organization and the individual student's learning style.

The more interactive the student is with the learning material the better outcome for the organization can be expected.

VI. CONCLUSION AND RECOMMENDATIONS

Organizational effectiveness is the result of both efficient utilization of resources and effective teaching to meet expected and measurable objectives. The current governmental impetus to curtail spending has led to both a downsizing of personnel and the desire to use the remaining personnel in a more economical, efficient and effective manner. In the educational arena this is a "Catch 22" in that the result implies that military officers should obtain masters degrees to advance in rank, but the cost of providing such education should decrease without disregarding the investment previously spent on these officers in obtaining their current specialty qualification.

As an example, a very large investment is required to train a Naval Aviator. There is a strong resistance to having this aviator leave flying duties during the career period in which he is eligible to attend the Naval Post graduate School. Unfortunately, as he gets older (and therefore, past his time of being a warrior), the Navy often loses him to commercial aviation. If he had gained relevant graduate education prior to that time, he might have remained in the Navy with a different "p-code."

If some component of graduate education could be delivered in another way (correspondence courses, Internet based, VTC, etc.), DoD might be able to provide the requisite education despite economic constraints. The development of distance learning alternatives could be done within NPS or outsourced.

This thesis recommends NPS conduct further research to design a data base to collect reliable and relevant cost data to support future cost studies focusing on course delivery options, including Distance Learning, as these options relate to coureware development and delivery costs and learning outcomes. One should also compare the equivalent existing distance learning courses for content currently offered at various institutions other than NPS for consideration as possible substitutions for NPS classroom instruction or as an alternative to "building" this courseware in-house. These courses could be recommended for students desiring degrees accredited through NPS but unable to participate in full time residential graduate education at the present time. This could shorten the overall time spent out of the workforce as well as increase the number of higher education degrees attained by our military and civilian personnel.

Given the availability of distance learning technologies, the availability of the Internet as a communications channel, and the potential of distance learning courseware authoring software to create, deliver and mediate student centric learning, the NPS should perform cost and learning outcome studies in order to make correct decisions regarding the distribution of education on the Internet.

APPENDIX A. GLOSSARY

Air National Guard (ANG): A wartime mobilization force providing personnel and aircraft to augment the active duty forces.

Air Technology Network (ATN): The Air Force education and training interactive video Teletraining network. Created in 1992 to broadcast the newly-required acquisition courses, ATN has expanded to four Uplink sites at Wright-Patterson, Maxwell, Sheppard and Keesler Air Force bases with more than 70 downlink receive sites typically located at the base education offices. The system used 1-way video, 2-way audio over a compressed digital video signal. Combined with ANG's Warrior Network, the Air Force can reach almost 300 sites with in the US.

Analog: A format in media, which captures and presents information in a continuous signal or stream. Unlike digital format, which encodes information into discrete bits, analog formats are continuous. Traditional analog formats include paper, photographs, film, video, photographs, and magnetic tape, all of which are readable without additional interpretation by computer software and hardware.

Asynchronous: Transmission which does not occur simultaneously with the audio and video associated the broadcast. Fax and computer responses system would be considered to operate in the asynchronous mode. Also refers to a DL delivery method that is learner centric and does not require "live" student-faculty or student-student interaction.

Audio Bridge: Specialized equipment that permits several telephone lines to be joined together in a conference call.

Bandwidth: The frequency width needed to transmit a communications signal without excessive distortion. The more information contained in a signal, the more bandwidth it requires for distortion-free transmission.

Binary Code: The basic level of digital electronic records consisting of bits (individual binary digits recorded as ones and zeros) making up bytes (a set of eight binary digits).

Compact Disk (CD): An optical disk on which digital text, audio, video, and graphics data is stored. Most CDs are read-only (CD-ROM: read only memory), although recordable Cdis (CD-Ris) are available that require record-capable hardware.

Computer Assisted Instruction (CIA): A term referring to courses delivered using a personal computer using floppy disks, CD-ROMs, or Internet-delivered courseware.

Computer Based Instruction (CBI): The same as computer assisted instruction.

Computer Based Training (CBT): The same as computer assisted instruction. CAI and CBI may be used to provide: Training CBT or Education CBE.

Compact Disk-Read Only Memory (CD-ROM): A disc designed to hold up to 600 megs of data in a digitized format. Because it is "read only," users cannot alter or write over the data on the CD making it very popular with courseware developers.

Compressed Digital Video (CDV): A digital transmission process used by commercial vendors and others to deliver TV-quality video in a way that reduces the amount of data required to be transmitted. While compressed video requires less bandwidth, signal quality is reduced. As a result, picture quality is not generally as good as full-motion, with quick motions often appearing somewhat blurred.

Computer Mediated Conferencing (CMC): Another way of conferencing using the personal computer and telephone lines as the communication vehicles. It provides instructor-student and student-student interaction in a synchronous mode.

Contribution: The difference between revenue and variable costs. Revenue - traceable variable = cross margin - trace fixed = contribution.

Crash: A catastrophic circumstance in which software, hardware, or media that store data cease to function, making information inaccessible.

Department of Defense Policy of Graduate Education for Military Officers (DoD): Directive 1322.10 dated 31 August 1990: This directive addresses "graduate education requirements for military officer positions and the utilization of qualified military officers in those positions." It is the policy of DoD that officer positions will be validated for graduate education where such education is "essential for optimum performance of duty." Guidelines are also provided for the development of appropriate criteria for assigning graduate education requirements to billets. These guidelines are reflected in the Navy-specific criteria contained in NAVPERS 15938 series, Vol. I, Part B.

Digital: Any information (text, graphics, audio, and video) that is translated into binary code

Digital Media: Physical objects on which digital information is stored (e.g., magnetic tape, magnetic and optical disks, etc.), or collections of digital objects; service.

Downlink: A location where equipment receives a satellite or ground based signal(s) for display on video, audio, or data receiving equipment. Normally downlink includes a room equipped for display of satellite signal(s) thorough a TV monitor and permits occupancy by 15 to 50 people.

Educational Skill Requirements (ESR): The ESR is the Primary Consultant's definition of education requirements to be met for a specific curriculum. The ESR is developed and reviewed (at a minimum) biennially during Curriculum reviews.

End Strength: The number of active-duty military and civilian personnel in the Navy on the last date of a fiscal year or other accounting period.

Exportable Training: Training that is sent out or 'exported" from resident course to field location.

Fixed Cost: Costs that do not vary with the level of activity or volume.

General and Administrative (G&A): Costs that do not contribute directly to a specific product or service, but to the overall operation of the activity.

Hyper Text Mark-Up Language (HTML): The language of the Internet allowing authors to link to their items.

Internet Based Training (IBT): A term referring to courses delivered via the Internet.

Indirect Cost: Costs that do not contribute directly to a specific product or service, but to a grouping of products or services.

Interactive Courseware (ICW): Any type of computer-controlled education or training that relies on student inputs to determine pace, sequence and content of training delivery using more than one type of medium to convey the content of instruction.

Interactive Video Teletraining (IVT): Describes all satellite-based instruction. Also called video Teletraining, interactive video training and business TV.

Local Area Network (LAN): A system that connects computers, printers and other officer equipment together within a defined area (like your office building).

Magnetic Disks (including "floppy" and hard disks): A common digital information storage medium similar to magnetic tape.

Magnetic Tape: A common medium for analog and digital information storage. In analog use, tape is used to store audio and video. In digital applications, tape is used to store text, data bases, graphics, audio, and video. Magnetic tape consists of a plastic ribbon backing coated on one side with an adhesive material containing particles of iron or other material that can be magnetized to record information.

Manual of Navy Officer Manpower and Personnel Classifications (NOCMSAN) NAVPERS 15839, Vol. I: This directive is issued as the principal reference manual for interpretation of coded entries on manpower and personnel documents and reports. Part E of the COCMAN lists established subspecialty codes and specifies General and Level criteria that have evolved over time to describe the relationship between billet requirements and job performance.

Manual of Navy Total Force Manpower OPNAVINST 1000.16 (series): This directive implements manpower planning systems by providing information, policy, tasking and procedures for acquiring and effectively managing all Navy manpower. Chapters 4 and 6 of OPNAVINST 100.16 details the documentation and processes for the Navy officer subspecialty system.

Migration: The periodic transfer of digital materials from one hardware/software configuration to another, or from one generation of computer technology to a subsequent generation.

Multimedia: Anything that includes or involves the use of several media within communications. The term has evolved to refer to any system or strategy that uses a combination of data, graphics, video and sound. Common storage systems include CD-ROM devices. Combined with hypertext or computer based instruction, it becomes interactive multimedia.

Open Standards: Specifications for computer system components that are proposed, defined, and maintained through public processes, and that enable hardware and software produced by different manufactures to operate together to provide ready access to digitally stored information.

Optical Disks: Any of several disk formats in which digital data is etched onto a reflective surface and read using a concentrated light beam. Optical formats include CD-ROM (read only memory) CD-R (recordabele CD), DVD (digitalized video disk), and WORM (write once, read many times).

Outputs: Measurable units of work or method of quantifying workload.

Payback Period: A payback period is a very common method of evaluating a capital expenditure. In this approach the annual cash proceeds (savings) produced by investment are equated to the original cash outlay required by the investment to arrive at some multiple of cash proceeds equal to the original investment. Measurement is usually in terms of years and months. For example, if the cost saving generated from an HRD program are constant each year, the payback period is determined by dividing the total original cash investment (development cost, outside program purchase, etc.) by the amount of the expected annual savings. The savings represent the net savings after the program expenses are subtracted. The payback period is simple to use but has the limitation of ignoring the time value of money. To illustrate this calculation, assume the initial program costs are $100,000 with a three-year useful life. The annual net saving from the program is expected to be $40,000. The n, $100,000/40,000 equals 2.5 years (Phillips, 1983, p. 193).

P-Code: A system for coding people and billets related to specific skill requirements. Requires extensive knowledge of theories, principles, processes and/or techniques certified through the acquisition of the master's degree for optimum performance of duty; also requires the conception, implementation, appraisal or management of complex Navy and /or DoD programs

Planning, Programming, Budgeting System (PPBS): A system designed to assist the Secretary of Defense in making choices about the allocation of resources among a number of competing or possible programs and alternatives to accomplish specific objectives in our national defense.

- A planning phase where the global threat is assessed and strategy to meet the threat is defined.
- A programming phase which translates the strategic plans into programs defined in terms of forces, personnel, material and dollars.
- A budgeting phase which expresses the programs in terms of biennial funding requirements.

Primary Consultant (PC): The cognizant flag officer who is the technical advisor for a specific subspecialty code.

Professional Continuing Education (PCE): Provides short course instruction in a broad range of essential educational programs to meet specific skills and functional competencies required in designated career fields. PCE courses provide students with the opportunity to think critically, plan strategically, and give them the ability to apply those skills and knowledge to undefined future programs and challenges.

Professional Military Education (PME): Education in the profession of arms and the employment of forces. It provides and develops the skills, knowledge, understanding and appreciation of leaders in the nation's armed forces.

Refreshing: A procedure used to maximize the life expectancy of magnetic tapes and disks. In magnetic tape, refreshing involves unspooling and rewinding tapes to relieve stresses. In addition, data on the tapes are transcribed and rewritten to refresh the magnetic signal and prevent data loss. In magnetic disks, the term refers only to the re-recording process.

Return on Investment: The term "return on investment" (ROI) may appear to be improper terminology for the human resource development field. The expression originates from the finance and accounting yield and usually refers to the pretax contribution measured against controllable assets. In formula form it would be the pretax earnings divided by the average investment. It measures the anticipated profitability of an investment and is used as a standard measure of the performance of divisions or profit centers within a business. For human resource development program evaluation, the return may be expressed in the following way:

> Return = net program benefits (or savings) divided by program costs (or program investment). The investment portion of the formula represents capital expenditures such as a facility or equipment plus initial development or production cost. (Phillips, 1983, p. 192).

Satellite Education Network (SEN): The transmission system operated by the ARMY from FT Lee, VA. This network serves more than 60 downlinks located at Army posts through out the US. The SEN is compatible with ATN.

Standard Generalized Markup Language (SGML): A standard coding system for creating documents that can be translated by different software into formats, links, graphics, etc. A commonly used type of SGML is Hypertext Markup Language (HTML)

Strategy: The stream of decisions about how organizational resources will be configured to meet the demands, constraints, and opportunities within the context of the organization.

Subject Matter Expert (SME): An individual who has thorough knowledge of a job, duties/tasks, or a particular topic, which qualifies him/her to assist in the training development process (for example, to consult, review, analyze, advise, or critique). A person who has high level knowledge and skill in the performance of a job.

Subspecialty Validation Review (PSVR): Replaced Subspecialty Requirements Review. Interchangeable with Zero-Based Review. The review of all subspecialty code requirements that become approved upon revalidation every two years.

Synchronous Instruction: The simultaneous participation of students and instructors interaction is in real time.

Total Force Manpower Management System (TFFMS): A simple authoritative source of manpower resources. A requirements driven manpower management system that tracks all manpower resources (requirements, authorizations and FYDP). The TFMMS system pertains to billet information not personnel data.

T-Net: A two-way video, two-way radio, slow-bit rate video system currently used by the Air Force Reserve Command. ATN can connect to and transmit over T-Net using special arrangements through Army's Satellite Education Network at Ft Lee. Due to the difference in system configuration and transmission rates, receiving locations may experience some difficulties in receiving clear video and audio signals.

Teleconferencing Technologies, Inc. (TTI): The manufacturer of the ATN audio hardware at each downlink. The TTI at each program active downlink who has responsibility for the acceptance, secure storage, distribution, control and return of assessment items.

Teleseminar: An interactive means of instructing learners at a distance through the use of one-way video and two-way audio over a satellite communication link.

Test Administrator: Person at a downlink who has responsibility for the acceptance, secure storage, distribution, control and return of assessment items.

Uniform Resource Locator (URL): An engineer's way of saying "Homepage address." It tells your browser where the file is located on the Internet and the type of file it is.

Unit Cost: The cost per output unit or total costs for workload produced divided by actual number of work units.

Unit Cost Method: A costing method that identifies direct costs per output; indirect and G&A costs; and develops a standard allocation rate.

Example: it takes 3 workers to produce a chair. Each earns $15 per hour and together they can produce 5 chairs per hour. We estimate 300,000 chairs will be produced this year.

Direct labor = $9 ($15 x3 = $45/5 = $9)
Direct materials = $20 for wood, $3 for varnish
Indirect costs = 600K ($600K.300,000) = $2
G&A = $300K ($300K/3000,000) = $1
Total unit cost = $35

Uplink: The location where equipment permits the transmission of video, audio, and data signals up to a satellite. Uplinks can have multiple channels for transmission purposes. An Uplink normally has the capability to function as a downlink.

Variable Cost: Items of cost that vary directly and proportionately with the amount of activity.

Video Teletraining (VTT): Job site training delivered to students at their base of assignment via satellite over the Air Technology Network.

Warrior Network: The name of the Air National Guard Satellite delivery system. All components within the network are compatible with the Air Technology Network. The Warrior network has more than 200 downlinks across the US.

Web Based Training (WBT): A term referring to courses delivered via the World Wide Web (Internet).

World Wide Web (WWW): A system for sharing many different kinds of information over the Internet. Designed in 1989 by researchers at CERN in Switzerland, the Web is accessed by browsers like Netscape or Microsoft Internet Explorer.

APPENDIX B. EDUCATIONAL SKILL REQUIREMENTS

IS0123 Computer Skills Development: An introduction to the use and operation of microcomputers with emphasis on applications in systems management. Exposure to pertinent software packages.

IS 318~~3~~5 Information Technology Management: A survey study of what constitutes information technology and the management aspects of developing and maintaining systems in support of the Department of Defense and Joint Services. Technology aspects of hardware. Operation system software. application software languages, database management, telecommunications and networking, system development processes, system integration, end-user computing, IT acquisition, IT organization and staffing issues, information privacy and security issues, and IT planning and strategies form the basis for management discussions. The course considers the IT management challenge: (1) Young Technology, (2) Sustained and Dramatic Growth, (3) Growing complexity associated with crating and maintaining IT systems, (4) A number of fragmented subspecialties exist today, and (5) downsizing and Re-engineering emphasis shifts the focus of application being developed from transaction based systems to decision based systems. Issues are discussed from the perspective of the functional manager and user of information systems and not that of the technologist.

***MA2300 Mathematics for Management:** Mathematical basis for modern managerial tools and techniques with emphasis on military applications. Elements of differential and integral calculus. Introduction to matrix algebra and solutions of linear systems of algebraic equations.

***MN 2031 Economic Decision Making:** This is a course in macroeconomics. It starts with a brief introduction to microeconomics scarcity, production possibility cures, and supply and demand. IT when proceeds to topics in macroeconomics; which include national income determination, inflation, unemployment, deficits; and that banking system. Also covered are the various schools of thought in macroeconomics: Keynesian, monetarist, rational expectations, and supply side.

***MN 2150 Financial Accounting:** Study of basic accounting concepts and standards for reporting an organization's results of operations, financial position, and cash flows. Specific topics include the accounting cycle, asset valuation, recording of liabilities and capital structure, and financial statement analysis. Includes discussion of the Defense Finance and Accounting Service and the Federal Accounting Standards Advisory Board.

***MN 3140 Microeconomics Theory:** This course reviews traditional microeconomics concepts, including demand, cost, perfect and imperfect competition public goods, externalities, and factor markets. Emphasis focuses on several these underlying these concepts, including optimization, incentives, efficiency, problem soling and strategic thinking. Defense applications are stressed.

***MN 3161 Managerial Accounting:** Introduction to the concepts and systems of cost determination. Emphasis is placed on translating cost concepts into a military environment and relating them to pertinent OMB Circulars and Defense Instruction of Economic Analysis. Topics covered include job costing system, overhead accounting and allocation, standard costs for control, flexible budgeting, cost-volume-profit analysis.

***MN 3172 Pubic Policy and Budgeting:** This curse analyzes federal fiscal policy with emphasis on resource decision making for national defense. The roles o the principal budget process participants are examined. Executive—especially DoD and OMB—and congressional budget processes are assessed t indicate how national security policy is implemented through fiscal policy. Spending for national security is tracked from budget submission through budget resolution,, authorization and appropriation. Budget formulation, negotiation, and execution strategies are evaluated to indicate the dynamics of executive-legislative competition over resource allocation priorities.

***MN 3333 Managerial Communication:** in the DOD Environment. This course provides DOD and International military officers and civilians with the communication strategies and skills needed to manage and lead in the dynamic DoD environment. Instruction focuses on writing informative and persuasive documents, giving succinct, easy to understand briefings, managing team communication processes, developing associates' communication competencies through various feedback roles and strategies, and listening analytically and empathetically. DoD cases, scenarios, and reading are used to analyze complex communication situations unique to the military.

MN 4105 Strategic Management: Study and analysis of complex managerial situations requiring comprehensive integrated decision making. Topics include operational and strategic planning, policy formulation, executive control, environmental adaptation and management of change. Case studies in both the public and private sectors are used. Particular attention is given to strategic management in the military context, and in the challenging DoD, DoN organizations.

MN 4145 Policy analysis: It introduces advanced microeconomics concepts, including cost benefit analysis, risk, strategic interaction and imperfect information. These concepts are used to analyze public policy issues, stressing defense-related resource allocation problems. These applications emphasize optimization, incentives, efficiency, problem solving and strategic thinking.

MN4151 Internal Control and Auditing: Study of the objectives and techniques of internal control systems and of audits of financial reports and records and of government operations, in accordance with Government Auditing Standards. Specific topics include the design and evaluation of internal control systems, audit reports, auditing standards, audit evidence and audit tests.

***NS 3252 Joint & Maritime Strategic Planning:** The student will have a graduate level understanding of strategy, especially maritime strategy, naval doctrine, and the effect of technical developments on warfare. The student will become familiar with the following subjects for the United States, its allies, and opponents: the roles and missions of military services, policy-making processes regarding the armed forces, history of joint and general staffs, joint planning for acquisition and operations, and current issues in defense reform and reorganization.

***OS 3006 Operations Research for Management:** A survey of problem solving techniques for operations research. Topics include decision theory linear programming, models, project scheduling, inventory, queuing and simulation.

OS 3101 Statistical Analysis for Management: A specialized course covering the basic methods of probability and statistics with emphasis on managerial applications. The course includes applications of probability models, statistical inference and regression analysis. Computation for these applications are carried out on a computer, using commercial software packages. Topics in probability include the binomial, geometric, Poisson, and normal distributions, risk and expected value. Parametric statistical techniques include significance testing and confidence intervals, together with point estimation of model parameter. Regression analysis includes simple linear regression and multiple regression, with estimation of parameters and test of hypothesis and confidence intervals for regression coefficients and the variance the error term.

APPENDIX C. COST PER CURRICULUM MODELS (VARIABLES)

A = Civilian Faculty Direct Reaching Salary
B = Include Civilian Faculty Fringe Benefits (21%)
C = Military Faculty Salary
D = Mission staff Direct Salary
E = Include Mission Staff Fringe Benefits (23%)
F = Academic Department OPTAR and Travel
G = Indirect Costs

Taking looking at Systems Management Department, the cost per student by this method resulted as listed showing an marginal cost differences that could be taken into account.

Curriculum	Total Cost	AOB	Cost Per Student
370 ITM	1,897,335	162	11,712
813 TLM	92,965	7	13,281
814 TM	120,752	12	10,063
815 A&CM	398,804	34	11,730
816 SAM	463,041	38	12,185
817 A	69,862	10	6,986
818 DSM	83,408	8	10,426
819 SIM	78,217	7	11,174
820 RP&M	122,189	11	11,108
827 MLS	382,638	38	10,069
837 FM	642,136	59	10,884
847 MPTA	612,124	59	10,375
		445	

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